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Volume XII APRIL 1951 No. 4

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DISEASES OF THE NERVOUS SYSTEM

A PRACTICAL JOURNAL ON PSYCHIATRY AND NEUROLOGY

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VOL. XII APRIL 1951 NO. 4

Published monthly by
PHYSICIANS POSTGRADUATE PRESS
277 Broadway, New York 7, New York

EDITORIAL OFFICES
UNIVERSITY OF TEXAS SCHOOL OF MEDICINE
800 Avenue B., Galveston, Texas

Entered as second-class matter at the Post Office at New York, N. Y.

DISEASES of the NERVOUS SYSTEM

A PRACTICAL JOURNAL ON PSYCHIATRY AND NEUROLOGY

Further Clinical Investigation of Tolserol (Myanesin)

ARTHUR O. HECKER, M.D., MARGARET MERCER, PH.D.,
and MARK A. GRIFFIN, JR., M.D.
Coatesville, Pa.

In a previous communication[1] we reported upon the effects of Tolserol (Myanesin) administered orally to a group of psychotic patients. Although findings were not conclusive as to beneficial results, there were indications that a central effect could be obtained in some instances. Others[2] have reported amelioration of anxiety through the use of this drug. Follow-up studies were indicated both on the basis of our first experiences as well as with the results reported by others in the literature.

The selection of cases for this clinical experiment ignored diagnostic categories, patient choice being made primarily upon behavior reactions. In the majority of instances, patients selected were those in whom an emotional factor appeared to be dominating the patient's reaction. A total of 26 patients was studied. Responses to Tolserol fell into 5 general types:

1. Release of blocking to recall and revelation of painful experiences with or without concomitant emotional release. In the former instance, a level of violent abreaction was obtained in one case.
2. Control of vivid emotional reactions (rage), or manic type of release.
3. Relief of overt anxiety with more logical, sequential alignment and expression of mental content.
4. A combination of the above 3 responses.
5. No response.

Recall and Revelation

The first patient was selected because anxiety tensions and resistance to discussion of traumatic material were impeding psychotherapeutic efforts. Several attempts at obtaining material under intravenous amytal and pentothal resulted in the patient's going to sleep when painful material was approached. There had been some slight breaking through of this resistance to discussion of traumatic events, but tension, blocking, and occasionally open hostility contrived to block any effective therapeutic rapport. Several score hours were spent with the patient by an experienced therapist.

CASE I: A male, W. W. II veteran, age 36, admitted to the hospital following an episode in which he became angry, belligerent, assaultive, unmanageable, and amnesic for the episode. He had experienced considerable heavy combat duty in the ETO, being wounded twice, but not suffering a psychiatric disability and having been separated from service on a non-disability discharge in October of 1946. For one year prior to admission he had noticed increasing irritability associated with increased tension and resort to use of alcohol. He later developed the episodic rage type of reaction which eventually led to his hospitalization. It was reported that during these rages he would often verbalize traumatic combat experiences associated with his hate for his captain and guilt over the death of a comrade. On admission he was clear, coherent and cooperative but tense and evasive regarding essential details of recent behavior and past experiences. In view of the failure to elicit combat material under amytal and pentothal, it was suggested that intravenous Tolserol be administered in an attempt to facilitate therapy by relieving the anxiety aroused by the recall of traumatic events. Under the effects of Tolserol, he revealed many details of his war experiences and of his hostile emotional attitude toward his family which had not been revealed previously. These

revelations were expressed with either appropriate or emphatic emotion and in contradiction to his usual, somewhat cynical and blasé attitude. The release of this material was subsequently used to facilitate psychotherapy.

In this case, we were impressed by the following:

1. The patient was able to elaborate a painful and anxiety producing past experience which he could not or would not reveal without the use of a chemical agent. Previous attempts with amytal and pentothal failed to facilitate revelation. In past efforts with the barbiturates sleep developed rather than revelation on dosages which, by experience, should not have produced sleep.

2. Under Tolserol, the patient lost his self-dramatizing attitude in revealing material of past events and approximated a normal emotional response in consciousness.

In view of our experiences with this case, we next selected a patient who reacted similarly to intravenous pentothal, i.e., with sleep rather than the expected revelation of past experiences. This case is presented in some detail in view of the more dramatic response to Tolserol:

CASE II: A male, W. W. II veteran, age 30. Admitted January 31, 1950, for severe, acute anxiety reaction of one week's duration. History revealed that the anxiety reaction dated back to combat experiences when he had been "blasted," and that the present episode was an acute exacerbation. Although the patient revealed some traumatic battle experiences in his first interview under intravenous amytal, subsequent attempts at revelation or synthesis with pentothal resulted in the patient going to sleep or into a deep somnolent state in which he mumbled unintelligibly. Occasionally he would state: "I didn't do it. I didn't do it." No maneuvering of dosage would produce further response. During interviews not associated with medication, tension of an extreme degree developed when conflictual or painful material was approached, and resulted in blocking and resistance.

On February 18, 1950 a preliminary test of 2 gms. intravenous Tolserol produced some relief of tension but little change in mental state. Tension returned subsequently and psychotherapy continued to be fruitless because of the resistance created by the activation of severe anxiety over recall of painful experiences. On March 6, 1950, a second attempt with intravenous Tolserol was made. Prior to injection the patient was very tense and physically rigid. In the course of one and one-half hours, 4 grams of Tolserol diluted with normal saline were given. After 10 minutes, when ½ gram had been injected, spontaneous nystagmus developed and the patient began to feel relaxed though "jittery"; 20 minutes after the injection was started, at which point one gram had been given, the patient began to talk more freely and felt more relaxed. He began to talk about traumatic incidents (about his brother-in-law, with whom he was having emotional conflict, and his recent illness) without much emotionality. One-half hour after the injection started, at which point 1½ grams had been given, the patient's tongue and speech became slurred, but he stated that it was much easier to talk. He was not so sure he was relaxed; 40 minutes after the injection was started (2 grams), the patient reported a dream which he had had on the previous Saturday night. He stated that there were parts of "the same old dream." In the dream, there were a jeep, a house, and a buddy named Joe and the patient running away. The patient then remembered waking up from this dream on numerous occasions, quite tense and screaming, "I didn't do it, I didn't do it." The patient wanted to continue talking about his dream but developed a severe headache. He became hesitant and exhibited considerable blocking. This became less marked and the patient began elaborating more on the dream. The people in the house which figured in his dream were German soldiers who could speak broken English. He interjected that "those soldiers that Joe and I killed were Germans." He now switched from the dream to revelation of a combat experience not previously revealed, recalling "running down a hill because others were coming." While running down the hill, Joe, his buddy, stepped on a mine. At this time, one hour after the beginning of this Tolserol interview, the patient was wringing his hands and extremely agitated. During the next 20 minutes, with a violent emotional abreaction, he continued relating this combat experience. During the recital he attempted to jump off the table and run. It was suggested to him that perhaps he wanted to do this, that the therapist knew this was what he was trying to do. This seemed to calm him somewhat although precautions were taken to keep the patient from hurting himself. The patient recalled that he and his friend Joe were sent on a mission to get a prisoner; that they were volunteers for the mission. They went to F——e for a Lieutenant B—— who had been taken by the Germans and was to be transferred safely back to the American lines following a German surrender. The patient recalled the blast of a mine that Joe had stepped on and although at this instant he could not remember exactly what happened immediately following the blast, he remembered some later incidents. He recalled that a jeep with several boys on it came to pick him up. They had one soldier on the jeep with a bullet in his shoulder. Then, they loaded a body, covered up, on a stretcher; the patient stated he didn't know exactly who it was. They were taken back to a field hospital. On the way, the patient saw a wrecked jeep with 2 bodies hanging from it which had been there in the morning when Joe and he were passing in the opposite direction. At the hos-

pital, the doctor gave the patient 2 shots. "There were many other guys lying around. Some of them were sitting in chairs, others were lying in litters." At this point the patient remembered that he felt extremely sick at the sight and stated that he felt sick every time he saw death. He went on to state quite emotionally that he never wanted to go to war, that he never would go again. He expressed the insight that he could now see where the jeep in the dream came from. The patient stated that he had not been injured by the shell blast; that he had only felt he couldn't go on. Then with increased emotion the patient recalled more details of the story of how Joe and he had run down the hill, preceded by Lieutenant ——, who had escaped from the house at the top of the hill, and that Joe had stepped on a mine. He recalled that the mine blew Joe's right arm almost off, blew the top off his scalp and that there was "lots of blood." Joe implored the patient to shoot him. The patient shot Joe 8 or 9 times and he remembered that before he had done it Joe had become quiet and it seemed that he was lifeless. The patient remembered that at first he thought he would pick up Joe and carry him back, but he saw that they were being pursued by the enemy. Sometime later, the jeeps appeared in the incident and the patient was taken back to the field hospital. Throughout the latter part of the interview the violent emotional abreaction persisted.

The day following the Tolserol interview, the patient appeared less tense than at any time since hospitalization. The entire battle experience which had not been revealed at any time previously was reviewed with the patient without the acute anxiety previously witnessed when this subject was approached. The patient did not complain of his usual tiredness. Two days following injection, he continued to be cheerful and relaxed and did not complain of the weariness previously experienced. Three days following the injection, the vein used was found to be tender and thrombosed. Psychotherapy proceeded rapidly and the patient was able to leave the hospital in a short time and has continued to make a good adjustment at home.

In this case, we were again able to obtain material with Tolserol where intravenous barbiturates failed because of the supervention of sleep. Further, a highly emotional abreaction occurred which produced a salutary clinical response akin to that produced by Fabing[3] in his work with blast casualties. The essential difference lies in the fact that the abreaction occurred in consciousness and not in a drug-induced hypnotic state.

Five other patients who exhibited strong emotional blocking to revelation of traumatic experiences or painful ideation responded with varying degrees of release under Tolserol whether given orally as elixir or intravenously. In each instance, the patient was selected because tension and blocking had occurred during therapy. In some cases, the patients were able to verbalize hostile thoughts and impulses, heretofore not obtainable, with undue emotion. One patient who had been having rather difficult conferences with the Vocational Adviser was given elixir of Tolserol before a scheduled interview without the Adviser's knowledge. The interviewer later remarked that the patient's speech "was louder, surer . . . the patient looked straight at me during the interview for the first time . . . was able to make up his mind as to what he wanted to do whereas formerly he was equivocal and doubtful . . . there was little anxiety."

Rage Reactions

Coincident with clinical evaluation of the effects of Tolserol on the group of patients with emotional blocking to painful recall and revelation, a group of patients exhibiting rage and manic type of hyperactivity were subjected to the drug. Three patients in rage reactions and two patients exhibiting manic type of excitement were treated.

CASE III: A male patient repeatedly developed a rage reaction, shouting and screaming at the therapist when asked questions relating to sexual experiences or his delusions of greatness. In the midst of a stormy interview, elixir of Tolserol was administered. He became noticeably calmer, ceased threatening the therapist and answered questions which previously produced rage in a calm, objective manner. Because the patient became so cooperative and had a good educational background, he was requested to write his impressions of the effect of the drug:

"This drug's early effect was to stimulate and to engender a reticent feeling caused by its unexpected reaction so quickly. I shuddered at the strong taste and wondered at its almost immediate numbing and dulling effect. Its tightening of the throat bothered me somewhat. As time progressed, I found the effects not dulling but a slowing of the process of thinking which might be compared to a train going along the tracks. Without the drug, my thoughts were more or less expressed through quickly to a definite conclusion. With the drug, the thoughts were slowed down to the extent that the signals were clearer along the way. The conclusions were not changed nor the process altered, but slowed to the extent that it took some effort to continue along the same train of thought. Its effect is to somewhat stabilize the emotion and to clear emotional reactions from the train of thought. It does dull the emotion, anger, to the extent that the

thoughts are not colored by anger or by emotional disturbances."

Later repetition of the drug produced the same effect of objectivity to the patient's ideation. No change in thought content occurred, however. Also, under Tolserol the patient would do figure drawings which he had previously refused to do.

CASE IV: A male patient in rage reaction over minor frustration concerned with a week-end pass. Pacing up and down the corridor, angry, tense and threatening. Given elixir of Tolserol. In 10 minutes became pleasant, affable, slow and calm of speech, stating that he was "feeling better and the medicine had calmed him down." He became quite cheerful, accepted the situation, slept well that night and left on a week-end pass the next morning. He kept repeating before departing that "that was good medicine and helped me a lot."

CASE V: A male patient, agitated, bombastic, grandiose, belligerent, threatening. Intravenous Tolserol given. Speech became quieter, less bombastic, less pompous. Patient relaxed. Gradually talked freely, giving a detailed history of events prior to his admission which he would not do previously and readily admitted mistakes whereas he had refused to answer direct questions prior to medication. Several months later, this patient returned from a week-end pass in a state of paralyzing panic. He was rigidly tense, staring, and resistive to any maneuver. He was unable to verbalize. Under pentothal he mumbled somewhat incoherently and when questioned concerning experiences at home went to sleep. He would reveal no information concerning mental content. Two grams of Tolserol were given intravenously in normal saline. Shortly after the appearance of nystagmus, the patient relaxed and began to verbalize quite freely, defining the frightening hallucinations which were producing the fear reaction.

CASE VI: A male patient screaming in dayroom, pacing back and forth, over-talkative, agitated, tense. Brought to physician's office where he remained tense, muscles taut, showed pressure of speech, circumstantiality. Claiming impending doom, patients all dead, not their own faces. Given elixir of Tolserol. Five minutes later began to be calmer. Gradually speech became relevant with decrease of flight of ideas. In 15 minutes patient was quiet and waiting for questions before answering. At the end of 20 minutes, stated: "that medicine you gave me is certainly relaxing. I was excited before I came in here." Within one hour his excitement had returned. One hour later (8:30 P.M.) a second dose produced calmness and patient was able to sleep the night through.

CASE VII: A male patient, suspected homosexual, but no admission of the fact. Exhibited manic pressure of speech, with resentment against hospitalization. Intravenous Tolserol given. Answered questions directly, freely admitted overt homosexuality. Within 30 minutes, speech was calm, less circumstantial, and he revealed much of his past history which he would not do previously.

Relief of Tension

Five additional patients with marked tension during psychotherapeutic interviews were relieved of tension during such sessions by the use of Tolserol. In these instances, the results paralleled those successful cases reported by Dixon et al and details are not indicated here.

Failure to Respond

Nine patients in this group failed to produce any clinically measurable response to the drug. Two of these patients were involutional psychoses of the agitated and depressed type. The remaining 7 patients were chronic schizophrenics with either a paucity of emotional response, confusion, apathy or detachment, or tenseness without emotional expression. This group confirmed our earlier report on the lack of effect of Tolserol on chronic schizophrenia.

Dosage

In our experience no real effect was produced unless the dosage was sufficient to produce a spontaneous nystagmus and this came to be the criterion for regulation of dosage in the individual case. This pertained with both intravenous administration and oral administration of the elixir. No side effects were noted other than sclerosis of a vein at the site of injection in one case. The highest dose given was 6 gms. I.V. over a period of 55 minutes. The most commonly used dosage was 2½ grams of elixir of Tolserol. For recall and revelation of painful experiences the intravenous route is preferred, giving 4 to 6 grams over a period of 1 to 1½ hours. The Tolserol is diluted with normal saline, given fairly rapidly until spontaneous nystagmus is produced and then more slowly, adjustments being made according to the patient's reactions.

Psychological Evaluation

In view of the above results, it was deemed advisable to review the psychological test data on this group of patients to determine whether or not there were factors present in this field which might correlate with the clinical response to Tolserol. Of the 26 patients 24 had been tested prior to this clinical experiment with Tolserol. The clinical psychologist was asked to review

her data for evidence of how anxiety might be operating in these cases and what effect the relief of anxiety might produce in terms of clinical response. She was not informed as to the actual clinical responses to Tolserol.

Analysis of Psychological Test Data

It is commonly known that anxiety reactions may be reflected in:

1. Lowered intellectual efficiency on such tasks as digit span and arithmetic in the Wechsler-Bellevue Scale.

2. Diffusion and toned down shading effects, evasiveness, compulsiveness and constriction in the Rorschach.

Three cases are here presented to indicate the type of independent analysis made by the psychologist.

CASE A among the 24 patients tested produced a Rorschach record characteristic of anxiety neurosis of the most extreme, disabling type. At the same time, the high digit span, arithmetic and digit symbol scores on the Wechsler Bellevue suggested that anxiety was not being consciously experienced. It seemed highly probable that relief from anxiety would cause a marked response and a probable release of repressed material. This patient proved to be the first case discussed in this report.

CASE B: The Rorschach record clearly shows absence of capacity for constrictive control, labile affect, and a degree of free-floating anxiety which would drive the patient into emotional reaction. The Szondi shows no repressive mechanisms, no barrier to emotional discharge, and at the same time a strong tendency to projection. One would assume that reduction of free-floating anxiety would permit this patient to calm down, since the driving force for his display of emotion (probably displaced to an external cause) would be absent temporarily.

CASE C: The Rorschach shows much capacity for emotional response and extremely limited intrapsychic activity to stabilize it. However, responses reflecting this capacity appear readily when the limits are tested, suggesting that constriction is not sufficiently great for much response to Tolserol to occur.

Similar analyses were worked out for the 24 patients who had been tested. They were then grouped for probable degree of response. Scores in the various Rorschach categories, Wechsler-Bellevue subtest scores, weighed scores, and Szondi profiles (for the few cases in which the Szondi was available) were tabulated and examined to see if any method of ranking might be devised on a quantitative rather than a qualitative basis. It became evident that movement, color, and absolute number of Rorschach responses were significant categories for ranking. While the material from the other tests contributed materially to qualitative analysis it did not lend itself to assignment of numerical ranks.

The hypothesis was formulated that constriction by anxiety could manifest itself by limitation of all or any in a varying degree of:

1. Intrapsychic activity which serves to mediate the impact between the self and the emotional stimulation of the environment by facilitating insight and the capacity to understand and integrate instinctual drives. (Reflected by M responses in the Rorschach.)

2. Emotionally-toned response to the environment which facilitates relationships and object cathexes permitting emotional discharge. (Reflected by color response in the Rorschach, sum C.)

3. Flow of association. (Reflected by the number of Rorschach responses.)

While anxiety may act as a constricting agent in limiting intrapsychic activity or emotional responsiveness as reflected by movement and color responses in the Rorschach, it must be remembered that these factors are also affected by psychosis. If the psychosis has become paramount so that events of the external world no longer need to be dealt with, anxiety is not needed and the capacity for anxiety may atrophy.

The degree of clinical response inferred from psychological test data and the actual degree of clinical response were now tabulated independently by the clinical psychologist and the psychiatrist in charge of the study. These rankings are recorded in Table 1.

TABLE 1

Patient	*Rank by Psychiatrist*	*Inferred Rank from Test Data*
1	4	4
2	1	1
3	1	No data
4	2	2
5	4	No data
6	1	2
7	1	1
8	4	4
9	1	1
10	2	3
11	1	2
12	1	2
13	3	4
14	3	3
15	4	4
16	2	2
17	3	3
18	3	3
19	2	3
20	2	2
21	4	3
22	2	3
23	2	3
24	1	3
25	1	3
26	1	2

It is shown in this Table that in only two cases the predicted degree of response inferred from test data differed by more than one from the degree of response rated by the clinician. Both these cases were too psychotic for prediction to be significant. Eleven cases showed one degree of difference which, in view of the roughness of both ratings, is to be expected.

In assigning rank by the psychologist, ranks from 1 to 4 were assigned each patient on the basis of M, Sum C, and N in the Rorschach record. It was assumed that M, Sum C, and N varied inversely with the amount of constriction and that the degree of response to Tolserol would vary directly with the amount of constriction. The ranks on the individual factors were compared with the psychiatrist's ranking of degree of response and it was found that correspondence was limited. However, when the mean rank on these factors was compared with the psychiatrist's ranking a significant relationship appears.

While the data lends itself readily to analysis by inspection, Spearman's method of rank difference was applied with the result that r.=.99 and PE=±.07. On the basis of this, we are justified in concluding that in this group there is evidence of a close correspondence between the inferred rank and the rank on degree of actual response. Correspondence is sufficient to warrant the assumption that an approximate estimation of degree of response to Tolserol may be inferred from the Rorschach protocol.

The qualitative analysis of test material available was found to yield remarkably accurate predictions of the form the response would take. It was also evident from the few cases on which the Szondi test was available that it is an excellent instrument for study of this type of problem. However, in the data available it is in the more objective analysis of Rorschach factors that the effect of anxiety on the personality structure makes itself most evident.

The results of the use of Tolserol on this small group of patients indicate that this drug seems to have a definite effect upon the nervous system and that it appears to be a valuable tool both for therapy and for investigation of psychological responses under relatively controlled conditions. The effects of Tolserol are transitory as the drug is rapidly destroyed in the body. It is not a therapeutic agent per se, but an adjunct to more specific therapy. Eschewing theoretical considerations as to its mode of action or its effect upon the physiological mechanisms of anxiety, there are definite indications that its use as an aid to psychotherapy should be studied further. In particular, it is suggested that investigators in a position to study its applicability in acute combat reactions or where anxiety or strong emotional coloring are predominant give consideration to testing its effectiveness.

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Authors' Note: This research has been sponsored by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

Nutrition Applied To Clinical Psychiatry*

JOHN D. MORIARTY, M.D.
Los Angeles, California

Nutrition Applied to Clinical Psychiatry

To those individuals who keep their concept of "body" and "mind" as separate entities it is often disconcerting to consider that nutritional disturbances are both a cause and a result of psychiatric problems. The role of emotional factors in human malnutrition has been dealt with in a prior publication.[1] At the moment our concern is chiefly with the nutritional deficiencies that are often found in the practice of clinical psychiatry. With improved techniques for the detection of these findings, it is incumbent on the psychiatric specialist to evaluate carefully the nutritional status of each of his patients.

Nutritional Examination

In appraisal of nutritional deficiencies the clinical examination ordinarily comes first in terms of estimating the more gross conditions. We have had trouble in convincing many of our patients that weight is often a poor index of nutrition and that more important are tissue turgor, contour and proportion of the body, and condition of the hair, skin, nails, teeth, gingivae, tongue, and other organs accessible to inspection and palpation.

A dietary history, which may be written out by the patient, gives a pretty good background for understanding much of the problem. It is often highly advantageous in office practice to have the patient keep an accurate account of everything he eats and drinks for 7 consecutive days and then have this tabulation subjected to diet analysis by the method of Walsh.[2] We then can graphically demonstrate that many patients who are on a "good" diet by their own evaluation have in fact a number of gross dietary deficiencies. Incidentally, by taking a dietary history the psychiatrist usually gains simultaneously an appreciable insight into a number of emotional factors in the patient's problem. For instance, certain food prejudices may be intimately connected with the individual's neurosis.

I have found it worthwhile to make certain biochemical and other laboratory examinations in many patients for additional appraisal. To mention only a few, the serum glucose or a glucose tolerance test may cast light on some of the mechanisms in cases where symptoms like anxiety, fatigue, and irritability are associated with hyperinsulinism. Determination of the urinary gonadotrophins is valuable in a variety of psychiatric syndromes, but especially in depressive reactions in the involutional period. In addition to giving an index of anterior pituitary function, this test may give an accurate reflection of gonadal and other "target" glands' activity. To this date, we have worked out only a rather general relationship between nutrition and endocrine balance, but the details are fast being filled in. Likewise, outside of direct determination of the serum ascorbic acid level, most of our laboratory indexes of vitamin deficiencies are only inferentially derived from other blood chemistry studies. In each psychiatric patient one of the main problems is to evaluate how much of his illness arises from nutritional deficiencies and how much from emotional tension and other factors.

Major Nutritional Disturbances With Gross Psychiatric Symptoms

Probably pellagra offers the best example of how profound disturbances in brain function can arise from malnutrition. Symptoms like dermatitis and diarrhea are much less impressive or troublesome than the third "D" in the triad—dementia. Many pellagrins show a severe confusional psychosis that usually responds more or less dramatically to specific nutritional correction, in the form of niacinamide and the rest of the B complex.

Related to but perhaps distinct from pellagra is a type of encephalopathy occurring in alcoholic patients, described in 1940 by

*Presented at the Annual Meeting of the American Academy of Applied Nutrition, Riverside, California, April 1-2, 1950.

Jolliffe, Bowman, et al.[3] The clinical picture of this syndrome consists of clouding of sensorium, cog-wheel rigidity of the extremities, and uncontrollable sucking and grasping reflexes. It is noteworthy that patients with this syndrome who were treated by routine measures and routine dietary program, plus thiamin chloride, almost invariably died (95 per cent). In a group of patients who received a more adequate diet and vitamin B complex and extra fluids, the mortality fell to 52 per cent. But in a third group treated with niacin, an otherwise limited vitamin diet, and fluids, the mortality was reduced to 14 per cent. Apparently this type of encephalopathy is due to a profound and acute niacin deficiency. However, in the therapy of such patients, it is always advisable to employ a balanced vitamin and mineral supplementation in addition to large doses of the specific niacin.

A similar syndrome occurs in non-alcoholic but debilitated persons, particularly arteriosclerotic and senile psychotics. Too often such individuals showing a more or less acute confusional episode are relegated to the status of custodial care in a rest home or sanitarium, the illness being considered an inevitable part of the aging process. However, in a significant proportion of cases, the primary etiology is nutritional deficiency, especially of niacin. These geriatric patients usually have multiple associated nutritional lacks, especially of proteins. To speak frankly, the dietary program of many institutions, especially those caring for the aged, virtually guarantees the development of these deficiencies, since their menus are heavily weighted with such devitalized foods as white bread, mush, macaroni, and puddings. In view of the fact that close to half of all the beds in mental hospitals in this country are occupied by patients with psychoses associated with senile and other degenerative cerebral changes, it behooves us to ameliorate their problems with a proper nutritional regimen.

Perhaps equally important as the changes in the central nervous system are the disturbances in the peripheral nerves of certain psychiatric patients. It is now pretty well established that the "alcoholic polyneuritis" frequently encountered in inebriates is actually a polyneuropathy similar to that seen in patients with beri-beri and other gross deficiency disorders, especially of thiamin. In this connection, it should be pointed out that the greater the intake of refined carbohydrates (which alcohol resembles in many respects) the greater the requirement for the B vitamins, particularly B_1. Contrastingly, in the case of psychiatric patients who by reason of their illness have brought about a more general state of starvation by avoidance of almost all food and drink, we do not ordinarily see a clear-cut polyneuropthy develop.

With reference again to inebriates, Strauss[4] performed an interesting experiment 15 years ago with 10 patients having "alcoholic" polyneuropathy. He let them continue their high daily intake of spirits while treating them with intramuscular injections of liver extract and a diet rich in the B vitamin. Since in each case a marked improvement of the neuropathy occurred, he concluded that it was due to dietary deficiency rather than to any direct neurotoxic effect of the alcohol. Other investigators have confirmed his results. Some, like Pearson,[5] have gone further and have shown that one of the best supportive measures for the problem drinker in his struggle for sobriety is the feeling of well-being that comes from careful, comprehensive nutritional correction.

As a corollary to this, Jolliffe[6] points out that he and his co-workers have never seen a case of acute peripheral neuropathy that did not simultaneously show some evidence of dysfunction of the cerebral cortex. The brain is dependent for its normal functioning, as he affirms, on a carbohydrate substrate, an adequate supply of oxygen, and various enzyme and co-enzyme systems. Since among the more important of these latter are thiamin, niacin, and riboflavin, it seems reasonable that a deficiency of any of them may interfere with proper utilization by the brain of its principal foodstuff—glucose.

Psychiatric Syndromes Associated With Sub-Clinical Deficiencies

In office practice one of the most important psychiatric syndromes encountered is a neurasthenic-like picture. In these cases

the patient usually complains of fatigue, irritability, trouble concentrating, headache, backache, and other vague or ill-defined somatic disturbances. When the physical examination and routine laboratory tests are within normal limits, such an individual is often classified without further ado as "just a neurotic." A careful nutritional inventory, however, may cast considerable additional light on the problem.

After a rather carefully controlled clinical experiment at the Rochester State Hospital, Williams et al[7] reported in 1940 that they were able to produce a full-blown neurasthenic picture in all of 6 patients by feeding a diet deficient only in thiamin (50 I.U. daily). Symptoms appeared usually within a few weeks and comprised generalized weakness, dizziness, backache, palpitation, precordial distress, dyspnea on exertion, anorexia, low blood pressure, and depressive moods, as well as disturbances in the electrocardiogram. As soon as the thiamin intake was raised to 2 mg. daily (660 I.U.), the patients rapidly regained a feeling of well-being. Similar experiments on a more extensive scale at the Elgin State Hospital bore out these results.

However, it should be pointed out that in ordinary practice the psychiatrist as a rule encounters multiple sub-clinical deficiencies, especially of proteins, essential trace minerals, and various vitamins. In such cases, giving of thiamin alone may have no beneficial effect and in large doses may even increase the deficiencies of the other fractions of the B complex. Likewise, it would be a serious error to assume that most neurotic illnesses are due primarily to avitaminosis B.

The dietary history, nutritional inventory, and clinical evaluation usually reveal that in the majority of such patients nutritional deficiencies of a multiple sort account for anywhere from 10 to 50 percent of their complaints. Due to impaired appetite, most of these neurotic patients have an inadequate food intake in terms of the basic nutrients. On the other hand, because of the symbolic aspect of such foods, they almost always ingest an excessive amount of sweets, pastries, and other refined carbohydrates. Due to disturbed gastrointestinal function, related to their emotional tensions, they have inefficient absorption and utilization of what nutrients they do ingest. It is thus not hard to understand the vicious circle that ensues. For the psychiatrist is therefore posed the problem of a combined therapy—nutritional correction and psychotherapeutic management.

Illustrative Cases:

Surveying a "typical" case history of such a problem, we might select that of Violet R., a 27 year old married stenographer. She was referred by a clinic specializing in marital problems, the patient's complaints being fatigue, irritability, numerous poorly defined somatic complaints, and marital discord. She had been married 4 years to a commercial photographer, had had one miscarriage but no children, and was becoming increasingly discouraged by a variety of psychosomatic difficulties as well as by lack of matrimonial happiness.

The past history revealed an absence of serious "organic" illnesses but a more or less chronic feeling of not being "up to par." Her childhood had been marred by considerable ill-will and bickering between her parents, which incidentally did not stop at meal times. As a girl, she was said to have a "delicate stomach" and when emotionally upset was apt to vomit or to eschew a meal. Forced by economic circumstances to continue working after her marriage, she had little time or inclination to prepare or to eat adequate meals. As her tension with her husband increased, a problem of sexual frigidity developed, associated with more fatigue and irritability.

One of the first steps in the therapy was to perform a dietary history and a diet analysis, which revealed certain major disturbances as summarized below:

Protein 58 grams—only 46% of calculated optimum

Fat 50 grams—only 90% of calculated optimum

Carbohydrates 175 grams—only 70% of calculated optimum

Calories 1410—only 70% of calculated optimum

Carbohydrate status showed 94 grams derived from refined sugar and grain products, or 54% of the total carbohydrate intake. This figure represents 460 calories derived from these foods, or 33% of the total.

Calcium—455 mgs. or 46% of optimum
Phosphorus—857 mgs. or 57% of optimum
Iron—7.8 mgs. or 43% of optimum
Iodine—33.5 mgs. or 44% of optimum
Vitamin A—2,800 U (USP)—only 38% of optimum
Thiamin—0.68 mgs.—only 35% of optimum
Riboflavin—1.17 mgs.—only 39% of optimum
Niacin—24 mgs.—only 38% of optimum
Vitamin C—94 mgs.—optimum
Vitamin D—23 (USP)—only 3% of optimum

Now, although to the trained psychiatrist this patient had a number of deep-level emotional conflicts and distorted emotional attitudes, the correction of her condition by psychotherapy alone would have undoubtedly been a long, drawn-out, and basically unsatisfactory process. Fortunately, she proved at the outset sufficiently flexible to accept without undue resistance a program of nutritional correction. Much progress could then be made in the first month of therapy, so that with the resultant gain in feeling of well-being and alleviation of tension and irritability the patient was able to attack her emotional problems with increasing vigor. I must caution the nutritionists, however, by observing that the nutritional program alone is not adequate to achieve a satisfactory result in such a patient. Other aspects, such as the rather profound disturbances in interpersonal relationships, require careful psychotherapy.

Case No. 2—To illustrate the close relationship between nutrition and psychosomatics is that of Charlotte B, a 33 year old divorced woman living in close but unhappy symbiosis with her highly domineering and chronically dissatisfied mother. This patient was referred for neurologic study as probably having a brain tumor or acute multiple sclerosis. She entered the office using a cane and dragging her right leg, other principal complaints being of headache, vomiting, and blurred vision. Careful neurologic examination revealed no definite organic disease of the nervous system, and the electroencephalogram was normal.

At the next visit she mentioned her loss of appetite and her concern about being so "fat." Gravimetric determination revealed that she was about 20 pounds heavier than normal for her height and bone structure but that the excess weight was clearly concentrated over the anterior thorax and abdomen, leaving the extremities relatively quite slender. Furthermore, despite what the scales reported, she was clinically in poor nutritional status. Dietary analysis revealed the following gross deviations:

Proteins—54 grams—37% of calculated optimum
Fats—64 grams—14% in excess of calculated optimum
Carbohydrates—160 grams—64% of calculated optimum
Calories*—1780—89% of calculated optimum

Carbohydrate status: The diet contained 80 grams of carbohydrates derived from refined sugar and grain products, which equals 50% of the total carbohydrate intake. In other words, the diet contained 620 calories derived from refined sugar and grain products, equaling 35% of the total caloric intake.

Calcium—1068 mgs.—optimum
Phosphorus—1258 mgs.—84% of calculated optimum
Iron—11.4 mgs.—61% of calculated optimum
Iodine—40.6 micrograms—41% of calculated optimum
Vitamin A—6,600 U (USP)—66% of calculated optimum
Thiamin—0.66 mgs.—33% of calculated optimum
Riboavin—1.97 mgs.—66% of calculated optimum
Niacin—11 mgs.—46% of calculated optimum
Vitamin C—56 mgs.—75% of calculated optimum
Vitamin D O—19 U (USP)—2% of calculated optimum

For nutritional correction, a dietary regimen of 1800 calories daily, with 125 grams of protein was instituted, emphasizing foods of high biologic value. This met with a good deal of resistance at first, the patient periodically sipping sweet wine and indulging herself on a pastry or two. Her weight in the next few weeks increased 4 pounds.

*However, 410 calories of the total were derived from alcoholic beverages, leaving only 1430 derived from food.

However, fairly intensive psychotherapy was simultaneously being administered, and through the technique of hypno-analysis, the core of her emotional illness was revealed.

In her relationship with her mother she had marked feelings of ambivalence—marked dependency and sense of obligation on the one hand and strong but buried feelings of hostility on the other. By her symptoms of partially paralyzed leg, vomiting, and capricious appetite she unconsciously made her mother wait on her and bring her trays from the hotel restaurant, and otherwise subtly retaliated for the mother's domination. This aspect of her illness was before long sufficiently alleviated to the point that nutritional rehabilitation could be hastened.

However, her excess weight did not yield to the dietary correction, although she did have increased feelings of energy and well-being. It was necessary for the therapist to uncover first the deep-level symbolic significance of the panniculus adiposa. It proved to represent unconsciously the body image of pregnancy and was connected with an abortion which she had undergone shortly before the onset of the acute symptoms of her illness and about which she had deep-seated guilt feelings. In the case of this patient, therefore, progress with psychotherapy had to precede nutritional benefits for the most part. Follow-up studies 2 years later revealed that she was feeling well, working steadily, and maintaining her weight at 124 pounds.

Summary

A careful nutritional inventory should be an integral part of every psychiatric study. The dietary history often gives insight into some aspects of the emotional illness, and the detailed dietary analysis often reveals unsuspected and significant deficiencies. Gross disturbances of nervous system function seen clinically in pellagra, in some types of alcoholic encephalopathy, in some geriatric patients, and in certain peripheral neuropathies require specific therapy, including especially niacin, thiamin, and riboflavin.

In office practice, however, subtle multiple but sub-clinical deficiencies are much more often the problem. In such patients with neurasthenic-like syndromes perhaps 10 to 50 percent of their symptoms are closely related to nutritional disturbances, particularly deficiencies of proteins, essential trace minerals, and various vitamins. Therapy of these patients requires a combination of psychiatric techniques and comprehensive nutritional correction.

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Application of Psychologic and Psychiatric Principles In the Army Leadership Program

COLONEL W. E. WILKINSON, M.C., U.S.A.*
Durham, North Carolina

In the Spring of 1943, the United States Army was starting to mature. The Armed Forces had almost their maximum strength. Most of the divisions had been activated. The Army had developed satisfactory training methods. Industry was geared to the necessary production for war. The Japanese had been halted, and the Allies had won an initial victory against the Germans by annihilating the Afrika Korps in Tunisia. As Mr. Churchill so aptly stated, "This may not be the beginning of the end, but it is certainly the end of the beginning." The initiative was passing from the Axis forces to the Allies, and even the most pessimistic of our planners had to concede that victory was possible if we could continue the pace set in 1942. It was at this critical period in the war that the General Staff suddenly realized, with no little consternation, that nearly as many men were being discharged from the Army as were entering through induction stations. This discovery was amazing since the Army had suffered comparatively light battle casualties, and illness from communicable diseases had been reduced to a rate lower than in any other war by modern preventive measures.

What then was the cause of this tremendous drain upon our man power? The answer was not immediately forthcoming but in retrospect it is now known that 1,850,000 of the men who appeared before the medical examiners of Selective Service were rejected for neuropsychiatric disorders. Even more startling is the fact that in spite of careful screening by Selective Service medical examiners and the induction station psychiatrists, 1,000,000 of the men inducted into the Army were admitted to Army hospitals for psychiatric disorders between Pearl Harbor and V-J Day, and 540,000 were separated from the service for neuropsychiatric disorders. In addition to these known psychiatric casualties, there were many other military personnel who were tried by courts-martial and confined in military prisons (72,000 general prisoners) as a result of behavior stemming from psychiatric disorders, and there were countless others whose performance of their military duties was inefficient as a result of their failure to make a normal adjustment to the military environment. Any one group of conditions which can eliminate such a large number of otherwise eligible men from service in the United States Army in time of great national peril is certainly worth considerable study and demands that every effort be exerted to prevent a repetition of such a situation.

It sometimes seems that the only thing we learn from history is the realization that we learn nothing. However, in 1946, the leaders of our country responsible for national defense took a determined stand in regard to the neuropsychiatric problem as it affects national defense. The Secretary of War and the Chief of Staff of the United States Army instituted a study to determine what we could do about the lessons learned in World War II. As a result of this study, it was decided to develop and put into operation a leadership program in the Army. Psychiatrists, psychologists, chaplains, and line officers worked together in formulating this program. At this time the Experimental Universal Military Training Unit, the Armored School, a branch of the United States Disciplinary Barracks and a training division for armored troops were located at Fort Knox, Kentucky. It was my privilege to be stationed at Fort Knox during this period, and I had the opportunity to work with these several military installations in the development and application of the Army Leadership Program. There are so many aspects to this plan that to discuss all of them would require more time and more space than is available to me in this paper. Therefore, I will limit my discussion to those

*Associate in Neuropsychiatry, Duke Hospital.

aspects of the program which have to do with the application of psychologic and psychiatric principles.

Our study was first concerned with finding out what sort of neuropsychiatric disorders rendered the men of our country non-effective for military duty. Then we wanted to determine when and where these neuropsychiatric disorders showed up; did they prevent a man from being inducted into the service; did the disorder first appear in training; or did it reveal itself under battle conditions. Then we were interested in learning, if possible, what caused the neuropsychiatric disorder. Then the solutions—what, if anything, could be done to prevent the occurrence of neuropsychiatric disorders. And if they did occur, what were the most effective methods of treatment for restoring non-effectives with neuropsychiatric disorders to military duty.

Our study brought out that most of the neuropsychiatric disorders were discovered at the time the men were examined by the Selective Service medical examiners. As has already been stated, 1,850,000 men with such disorders were rejected by Selective Service. This was 12 percent of all the men examined, and represented 38 percent of all rejections. Of the 1,850,000 rejectees, 37 percent were rejected for mental deficiency; 25 percent for psychoneurosis; 17 percent for psychopathic personality; 15 percent for neurological diseases; 1 percent for psychoses, and 5 percent for all other psychiatric disorders.

Let us consider the rejections for mental deficiency. It has been pretty well established that a man with an I.Q. of less than 70 cannot be depended upon to perform the many and varied duties of a soldier in a highly technical modern army. Therefore, as to these, there were two alternatives; to reject all individuals with an I.Q. of less than 70 or to organize some sort of special units, such as labor battalions, which would be able to make use of individuals with mental deficiency. The Psychiatric Division of the Surgeon General's office recommended that such labor battalions be organized, but these recommendations were not acceptable. It seems worthwhile to seriously consider again the establishment of some service organization which could utilize the less severe cases of mental deficiency. There are many jobs in the Army which could be successfully performed by individuals with an intelligence quotient of less than 70. There would be at least two real advantages to a program which would utilize mental defectives in these simple jobs. In the first place, we would make a better use of a cross-section of the manpower in the country and in the second place we would not be boring more intelligent men by having them perform tasks which do not keep them interested. Undoubtedly, many of the psychiatric casualties which occurred during the war were due to the fact that intelligent people were given jobs of a routine nature which were so monotonous that they either developed a psychiatric disease or became disciplinary problems. We might also reflect on the possibility that sending only the fit to war would kill off the fit and promote the survival of the unfit.

Before discussing the psychoneuroses, the psychopathic personalities, and the psychoses, it might be well to summarize briefly just what the military means by these terms. An effort to make the Army Leadership Program as simple and as practical as possible brought forth the decision to classify everyone into one of four groups. First is the normal group composed of people with at least average intelligence with a minimum of psychoneurotic tendencies and psychopathic traits. The second group is the psychoneuroses, meaning those individuals who react to the stresses and strains of military life by becoming sick physically or mentally. The third group is composed of psychopathic personalities, individuals who react to military stresses and strains by behavior disorders such as criminal behavior, insubordination, inability to accept discipline, alcoholism, or by becoming sexual deviates. The fourth group are the psychotics.

The military establishment would prefer not to have psychoneurotics, psychopathic personalities, or psychotics inducted into the military service. However, in the present world situation where the East is divided against the West, we find that we are on the side of the group of nations which has the smaller number of men available for military service. Therefore, it is necessary for

us to make every effort to utilize our manpower in the most efficient manner.

A number of civilian psychiatrists made a report on this subject at the close of World War II. Solomon and Yakolev have discussed this problem in their book. These psychiatrists conclude, among other things, that there is probably no other single step which in return for so little expenditure of time and money pays so generous a dividend to the inductees, the Army, and the Treasury as the effective screening of the mentally unfit for military service. However, they point out that we have no effective method of determining in advance who is going to crack up in the military service and who is not. One of the purposes of our studies at Fort Knox and elsewhere was to attempt to resolve these two somewhat conflicting conclusions.

During a war or during a general mobilization time is a very important factor. There are not enough psychiatrists and not enough time to permit effective screening of inductees. Therefore, our group at Fort Knox sought a test of some kind to be administered to groups for the purpose of determining who should be inducted, who should not be inducted, and what sorts of assignments those who are not inducted should be given. We finally selected the Minnesota Multiphasic Personality Inventory Test. This test can be used effectively to classify people as normal, psychoneurotic, psychopathic, or psychotic. The test was given to all officers in the advanced class at the Armored School over a period of three years. About 150 officers selected because of their good military records attend this class each year. Practically all officers going through the school in 1946, 1947, and 1948 were veterans of World War II. With two or three exceptions, all of the 450 officers in this group fell within the range of normality, but we were able to classify them as tending to be more like the psychoneurotic or more like the psychopathic personality. After such classification a study was made of their war records and it was found that those who tended toward psychopathic personality, almost without exception, had had combat assignments. Further an unusually large proportion of these individuals were either in airborne or armored divisions. Interestingly enough a large percentage of these were wounded. It is also interesting that they were the group of officers in the Armored School who received most of the decorations for gallantry and valor. As a group they did not crack up under the stresses and strains of battle. A fairly large proportion did get into disciplinary troubles of one sort or another.

On the other hand, the group of officers who tended to be more like the psychoneurotic nearly all had had administrative or non-combat assignments during the war. This group had a high rate of physical illness during the war and an appreciable number of them developed actual psychoneurotic illnesses requiring hospitalization. These individuals as a group received decorations, not for gallantry and valor, but for good conduct and excellency in administrative matters. There were only two individuals in this group who tended toward psychoses and both of them were undergoing psychiatric treatment at the time that the test was made.

Practically all the officers tested at the Armored School were Regular Army officers, and as such, had a choice as to what sort of assignments they would have during the war. It is also interesting to note that a number of the officers who tended toward the psychoneurotic had initially started out in the war in combat assignments but had been reassigned for various reasons to non-combat assignments. On the other hand, almost all in the psychopathic tendency group who were in airborne divisions or who were forward observers in the artillery had volunteered for this type of assignment and had stuck to that assignment during the entire war.

We concluded from this particular phase of the study that such a test as the Minnesota Personality Inventory Test would be useful in evaluating military personnel prior to assignment. We were planning to make practical application of this in the Experimental Universal Military Training Unit, but the Congress decided to discontinue this unit before we had an opportunity to carry out our plans. However, in the Experimental Universal Military Training Unit, we did administer the Minnesota Test to all the

trainees with informative result. There were eight individuals in the unit who showed definite signs of psychosis on the personality test. The company commanders were advised of this and were directed to pay special attention to these individuals. Without exception, these eight individuals did have difficulty in their adjustment to military life and three of them had to be separated from the service with a diagnosis of schizophrenia. The remainder of the trainees tended to be more like the psychoneurotic or the psychopathic personality with a ratio of about 60 percent psychoneurotic and 40 percent psychopathic personality. This was explained to the company commander and they agreed that it was a great help to be able to know in advance who was going to be more likely to go A.W.O.L., get drunk, get into fights, contract venereal disease, or otherwise become behavior problems, and the company commanders felt that they were able to prevent a great many of these difficulties by being forewarned. The unit surgeons were equally pleased with our success at predicting that the group with psychoneurotic tendency would be the ones who would show up most frequently on sick call; and, being warned in advance, they examined these individuals carefully the first time they reported for sick call, made the necessary tests, and observed them sufficiently to be able to rule out organic disease. Having definitely ruled out organic disease, they reassured these individuals, discouraged them from returning repeatedly to sick call and perhaps helped prevent the chronic invalid pattern from developing.

It was decided that in order to get the full cooperation of unit commanders, all officers should be given a basic course in psychology and psychiatry. There was much opposition to this plan initially, many line officers having a poor opinion of psychiatrists. This probably resulted from the fact that the psychiatrist assigned to combat units during the war had, for the most part, been very briefly trained and in many cases did not perform their duties as well as they should have had they been better trained. Opposition also stemmed from the belief that a little knowledge was a dangerous thing and that since you could not make psychiatrists out of unit commanders, it would be better not to attempt to teach them anything about psychiatry. However, the Military is so organized that the unit commander is responsible for everything that takes place in his unit. This includes the responsibility for preventive medicine, adequate medical service, and now officially includes preventive psychiatry and mental hygiene. The preservation of the mental health of his command by proper leadership is the responsibility of the unit commander, just as the prevention of communicable diseases through the practice of military sanitation is the responsibility of command. This does not mean that line officers are to attempt to assume the role of psychiatrists any more than giving them the responsibility for military sanitation means that they are to assume the duties and responsibilities of preventive medicine officers. The United States Army Officer is an intelligent individual and he can be expected to achieve the maximum of success in carrying out any program only if he understands the basic principles underlying what he is trying to do. Therefore, the courses of instruction at the Military Academy, in R.O.T.C. units, and in all the service schools include a course on leadership, and part of this leadership course is devoted to basic principles of psychology and psychiatry. The part of the course dealing with psychology and psychiatry is taught by a psychiatrist.

In this course there is presented a brief resumé of psychological evolution and biological evolution. The physical, mental, and emotional development of the individual from birth until adult life is discussed briefiy. The development of the individual is compared with the development of the race. Then the basic needs, such as the need to be safe, the need to belong to and be approved of by groups, the need to attain power, and the sex need are discussed, and it is explained how induction into military service in time of war or national peril threatens these basic needs. Methods are then worked out for minimizing the threat of the military establishment to these basic needs. It is explained how the superego or conscience develops in an individual as the individual grows from infancy into adult

life. The influence of parents and family, schools, religion, and culture of our country are pointed out as being the important factors in determining what sort of a conscience the individual will have. There are many practical applications of this understanding. For example, it is pointed out that induction into the military service in time of war is a great threat to one's need to be safe, but by developing high morale among the troops the need for individual safety can be changed or sublimated into a need for group safety. Conflicts which develop as the result of the individual having been trained to live peacefully with his fellow man make necessary the development of a program which will train the individual to be willing to be ruthless on the battlefield and to be able to kill the enemy. There is also a discussion on the functions of the ego, and, it is explained that regimentation and standardization are frequently an insult to the ego of the inductee. Practical methods are worked out for maintaining regimentation and standardization with a minimal adverse effect on the pride of the individual soldier. There is also a discussion of the unconscious, and the officers are given a working understanding of the mechanisms of such things as conversion hysteria with a reference to conversion hysteria versus malingering.

It is explained that people can be classified as either introverts or extroverts. Of course, some people are more introverted than others and some are more extroverted than others, but most people are either more like the extrovert or more like the introvert. It is believed that this is of help to classification officers because the introvert type of personality is more likely to do well in jobs such as company clerk or working in the Finance or Quartermaster Department, while extroverts are more likely to make a successful adjustment if they are given jobs with more activity such as assignments with tactical units.

It is believed that an understanding of mood swings is of great value to line officers. It is pointed out that almost everyone does have mood swings but that in normal persons the curve of the mood swing is so nearly smooth that the person is not upset by being a little depressed or a little pepped up. However, the wise leader should be able to observe changes in mood among his men and when they are depressed they should not be pushed too hard and when they are somewhat elated they should be cautioned to slow down. An understanding of mood swings is of particular value in battle. In hard-fought battles the winner is frequently determined by the ability of the leaders to continue to fight even when the odds seem against them. If a leader happens to be in a pepped-up mood he is more likely to continue to fight until he wins. On the other hand, if the leader is depressed during a very hard battle he is more likely to become discouraged and to give up.

Colonel Marshall has made a study of the behavior of front-line infantrymen and has reported his observations.[3] Colonel Marshall demonstrated that a remarkably small percentage of frontline infantrymen actually in contact with the enemy ever fire their weapons at the enemy. He concluded that a large percentage of the men in the infantry would not attempt to kill the enemy unless they had been aroused by anger or unless it was necessary to kill in self-defense. He also observed that troops who had been in the line for a long time frequently identified themselves with the enemy. For instance, soldiers in the mountain fighting in Italy, after long periods in the line, began to feel more closely related to the German soldiers who were having to undergo the same hardships than they did toward the American people back home who were getting rich doing war work and enjoying all luxuries at home. However, when the Germans began to use "Bouncing Betty" anti-personnel mines which bounced out of the ground when the soldiers stepped on them and exploded at about the level of the soldier's face, frequently producing terrible disfiguring wounds on their buddies, the American soldiers became very angry with the Germans and were more willing to kill. These principles can be made use of by our staffs responsible for propaganda and for training methods.

An understanding of the true nature of homosexuality is of help to Army leaders. In the course of leadership, they are told

that everyone passes through a homosexual stage of development and that most people mature from homosexuality into heterosexuality. However, a few individuals never make this transition and remain homosexual all of their lives. Other people are bisexual in adult life and have both homosexual and heterosexual drives. It is also explained that the high incidence of homosexuality in an army during wartime is due to a reversion back to the homosexual stage. When soldiers are separated from normal female contacts and are thrown closely together with their buddies in a dangerous situation, they may either disintegrate as a military unit or they may develop into a military unit with very high morale and esprit de corps. If the latter takes place, homosexuality frequently increases and an understanding of why this is true prepares the officers to deal with this problem in a realistic manner.

I would now like to touch briefly upon the management of neuropsychiatric casualties in the Army. Until recently, there were many military leaders who believed that there was no excuse for an individual developing a psychiatric illness in battle and many of these leaders were in favor of disciplinary measures, rather than psychiatric treatment. Some of the young doctors, who had had a six-weeks course in psychiatry, frequently went to the other extreme during World War II and tended to excuse all cowardly behavior in the face of the enemy as being due to a psychiatric illness. In the new program a compromise between these two extremes is attempted. If military leaders have an understanding of the true nature of "combat fatigue," they are better able to work with psychiatrists in deciding what to do with the casualties that do occur. One of the big problems in the management of combat fatigue casualties in combat units is to work out some method whereby the casualty can save face. If the casualty is evacuated to rear areas such as general hospitals in the Zone of Communications, everyone knows that he has become a combat fatigue casualty, and when the patient is restored to normal health he finds that he has lost face when he returns to his unit. However, when the regimental commander and the division commander learn that many of these cases can be treated in the regimental or division area, the soldier is never dropped from the rolls of his unit. Frequently a mild case of combat exhaustion, if it is diagnosed early, can be cured completely by one or two days and nights of rest in the regimental aid station or in the division clearing station. When this is handled as a period of rest for a tired, worn-out soldier, the soldier does not lose face and is able to return to his unit and continue as a combat soldier. It is very important for military leaders to understand that the chances of recovery are much better if combat exhaustion is recognized early and the patient is given an opportunity to rest before he loses complete control of himself. Once soldiers in a unit begin to crack up combat fatigue becomes contagious and the morale of the whole unit suffers greatly. For this reason combat exhaustion casualties are evacuated in a separate chain of evacuation—that is, they are separated from the physically sick and the wounded. Every combat division has a division neuropsychiatrist who advises the division surgeon on all matters pertaining to the mental health of the command and in the infantry division where most of the combat exhaustion casualties occur, there are two psychiatrists—one is the division psychiatrist who acts principally as a staff officer, while the other operates the combat exhaustion treatment center in the division clearing station.

Doctors of different psychologic and psychiatric thought and theory are brought into the military service in times of general mobilization. However, in the Military it is necessary to have standardization. First of all, there must be agreement as to what basic principle are to be taught, and emphasis must be placed on practicality rather than theory. Such a standard program has been adopted by the Army and doctors entering the service must conform to this standard program. That does not mean that the program cannot be changed if it doesn't work. However, the change must be made by the General Staff in Washington on the advice of the Chief Psychiatrist in the Surgeon General's office and the civilian consultants. Changes may not be made at lower levels

such as armies, divisions or hospitals. This principle applies to the treatment of neuropsychiatric casualties. The treatment must be standardized throughout the military service. The reason for this is that casualties in the Military are not treated in one location or in one hospital or by one group of doctors. The battalion surgeon first sees the casualty on the battlefield. Then he goes to the regimental aid station. Later on he is sent to the division clearing station and if his disorder is serious enough, he then goes back to Army hospitals, later to hospitals in the Zone of Communications, and finally to hospitals in the Zone of the Interior. If a standard form of treatment is not used through the military service, confusion and unsatisfactory results will prevail as a result of changing treatment principles in the several echelons in the chain of evacuation.

Summary

The Army Leadership Program has as its purpose the training of military leaders to understand human nature and human behavior so that they will be better able to predict and control human behavior. In order to do this, military leaders must have an understanding of the basic principles of psychology and psychiatry. By applying these principles we expect to be able to utilize a greater proportion of the general population in the military service. We will be able to more nearly assign the right man to the right job. A great many neuropsychiatric disorders can be prevented. The disorders that do occur will be handled more efficiently.

Colonel Marshall[3] concludes that "national strength lies only in the hearts and spirits of men. The search begins at the cradle where the mother makes the decision either to tie her child to her apron strings or to rear him as a man. It continues through the years of schooling, when children are taught either to place personal interest uppermost or to think in terms of their responsibility to their society, their country, and all of mankind. It carries into the halls of government, where our lawmakers may vote either to awaken our youth to a new understanding of duty, or to continue the indulgent course which is more likely to find favor with the majority of their constituents." However, until this ideal situation is attained, the Military will be confronted with the problem of taking citizens as they exist and molding them into the best possible fighting men. Military leaders will be better able to do this if they understand that "a man so often wants to do two opposite things at the same time, and he wants desperately to do both. He wants to dominate other men and yet be liked by them. He wants to give vent to his anger, but he doesn't want to get into hot water. He wants to gain promotion, yet he doesn't want to do hard work. Above all he wants to be a brave and true soldier, to keep the soldier's faith, and yet he wants to live; how to be brave and safe, that is the greatest psychological problem for the soldier. Most of the war neuroses result from the failure of men to find any sort of satisfactory way out of that dilemma. Many of those who do find the answer find it in the mental security of cooperative bravery in the fighting Army unit, or they find another substitute. They learn to want permanence for the things they love, instead of trying desperately to hang on to life itself."[4]

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Influence of Benadryl Upon Electromyographic Recordings In Parkinsonism

JOSEPH J. GITT, M.D., WILLIAM M. LANDAU, M.D.*
and MARGARET H. CLARE, B.S.**
St. Louis, Missouri

Paralysis agitans was known to the ancients. Parkinson[1] in 1817 gave the classic description of the condition to which few clinical findings have been added. The main features of the condition are the alternating rhythmical tremor of the extremities or trunk at rest and cog wheel rigidity. The latter may be present in the absence clinically of the former, or vice versa.

The therapy has been and still is empirical. A number of drugs such as marmine, bulbocapnine, cobra venom, amphetamine, curare, atropine, Bellabulgara, Rabellon, Vinolin and hyoscine hydrobromide have been used to obtain some relief for the tremor or rigidity or both.[1,2,3,4] McGavack et al.[6,10] first used Benadryl clinically in a variety of conditions including 4 cases of paralysis agitans and found it to be effective in lessening tremor and rigidity. In 1945 Loew et al.[5] first published data on Benadryl, a synthetic benzhydryl alkamine ether. It was found to be an effective antihistaminic drug. Other investigations, especially by McGavack and his collaborators[6] and McElin and Horton,[7] have shown it to be a powerful antihistaminic and antispasmodic drug. It is easily absorbed and diffusable and is found within 60-90 minutes after ingestion in the blood and in the cerebrospinal fluid at comparable levels. The drug has no effect on the normal constituents of the spinal fluid. It easily permeates the meningeal capillaries.[8,9]

McGavack et al.[10] tried the drug in many conditions including 4 cases of paralysis agitans and 3 were improved. In a case of Pagets disease with paralysis agitans the tremor alone was observed to improve. Budnitz[11] reported using the compound in 8 cases with symptomatic improvement. He felt the action was due to an atropine like effect. Others, as Ryan et al.,[12] have found too that rigidity and tremor are greatly lessened in most of the cases and that improvement occurs in speech, mobility, and muscular cramps.

Accordingly, it was decided to test the influence of Benadryl on electromyographic recordings of tremor and rigidity in 13 selected cases of paralysis agitans with the view of determining its action in reducing the principal parkinsonian symptoms. Intravenous injection of 30 mgm. of Benadryl has proved a useful therapeutic test for determining the probable effect of continued oral administration of the drug in alleviating the clinical symptoms of parkinsonism.[7,10] This dosage was therefore employed in the following experimental recordings.

Technique

The electromyographic technique described by Bishop, Clare, and Price[13] was used upon 13 selected cases of paralysis agitans and post-encephalitic parkinsonism, and upon 2 normal controls. Combined EEG and EMG recordings were carried out upon the controls, only EMG recordings upon the subjects of parkinsonism. Neither controls nor subjects had had any sort of drug in at least the previous 36 to 48 hours before examination.

It has been previously found[13] that as the emotional tension associated with the test situation diminishes during the course of the examination, there is usually considerable spontaneous improvement in the clinical and myographic picture. In order to obviate this factor all patients were given a control EMG recording to familiarize them with the technique and the examiners. They then returned 7 to 14 days later for the test recording. A preliminary record was ob-

From the Laboratory of Neurophysiology, Department of Neuropsychiatry, Washington University School of Medicine, St. Louis, Missouri.
*National Paraplegia Foundation Fellow in Neurology.
**Scottish Rite Masons Fellow in Neurophysiology.

tained before 30 mgms. of the drug was given intravenously. During the control recording and after the injection, activity was recorded at rest and during flexion of the elbow joint through a range of 30-45° and relaxation to the resting position. The movement was performed without added resistance, and with 100 gm. and 1000 gm. weights. The muscles examined were biceps brachii, triceps brachii, and brachioradialis.

The action currents were recorded on the electroencephalograph employing both surface electrodes placed close together on the muscle belly and bipolar grounded shaft needle electrodes for recording motor unit responses. A cathode ray oscillograph could be plugged into any channel ahead of the filters.

The chief difficulty met with consisted of extraneous potential variations due to swinging of wires and movement of contacts during violent tremors. This could usually be avoided by attaching the wires to the skin with adhesive tape near the electrodes and by keeping the leads as short as possible. The electrodes consisted of drops of a wet mixture of one-third plaster of paris and two-thirds powdered modeling clay. Into each drop of this paste the terminal of a lead wire was inserted before it set. This fixation of the wire prevented any movement at a metal-fluid contact. A ground electrode, consisting of a band of thin spring bronze covered with wet gauze, was wrapped about the upper arm. The recording technique was in other respects similar to that for electroencephalograms but paper movement of the inkwriter was at 6 cm. per second. Oscillograph records were taken on a bromide paper strip moving at 33cm. per second. Although both surface and needle electrodes were usually employed, it was found that the over-all picture of a given muscle's activity obtained from surface leads was more useful for our purpose than that of the action of a few selected motor units.[13]

Results

Two normal subjects were used as controls. In these trials simultaneous EEG records were made. As previously described by Schwab and Cobb[14] there was no synchronization of activity between the EEG and EMG records. This was true both before and after the administration of Benadryl. It was noted also that the EEGs showed no alterations in their rhythm or amplitude. The EMG recordings showed no significant change after the intravenous Benadryl.

Thirteen cases of paralysis agitans were recorded. Their ages varied between 31 and 83 years and all had had symptoms for at least several years. Some were ambulatory, others were chair-ridden. Nine of the cases showed tremor, seven with cog wheel rigidity; two with very little cog-wheel rigidity; four showed rigidity with little or no tremor.

The most striking changes were seen in the group with tremor. Before medication, these all showed regular alternating tremors at rates of 3 to 5 per second, the brachioradialis usually showing activity synchronous with that of the biceps. Very little interburst activity indicative of tonic rigidity was seen in the resting records. Figure 1, A, B, C shows typical resting activity in three cases before and after administration of the drug. Within one to five minutes after the injection, the amplitude of the EMG potentials decreases greatly and the tremor disappears or becomes just visible. When it still is evident, its rate and general character are unchanged. The decrease in amplitude is of the order of 50 to 90 per cent. Figure 1 D, E shows needle records of tremor activity before and after Benadryl. There is no significant change in single motor unit patterns.

Before medication there was considerable variation in the myographic pattern during flexion. The tremor in the flexor muscles usually tended to be converted to tetanus. In some cases the tremor was evident throughout the contraction; in others it would resume during contraction, usually when the arm had reached a static flexion posture; in still others it would remain in abeyance until after relaxation. The triceps showed some degree of relaxation with tonic or tremorous activity usually corresponding to the pattern in the flexors. Occasionally there would be doubling in frequency in the flexors (alternating and synchronous with the antagonists) during flexion. A marked

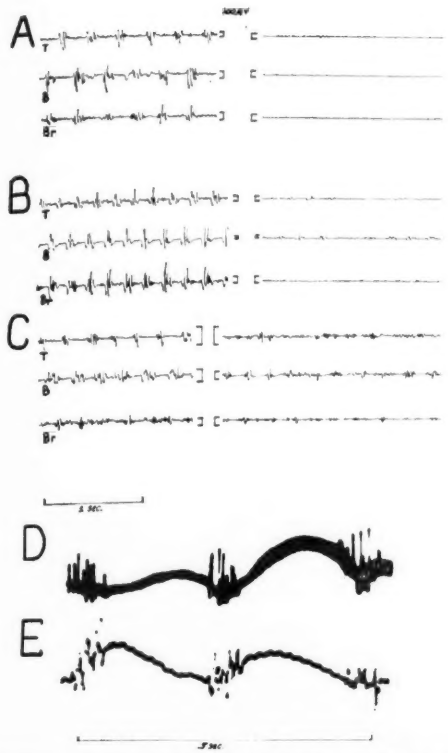

Figure 1. A, B, C Surface leads, resting activity in three patients before and after intravenous Benadryl. T=triceps; B=biceps; Br=brachioradialis. All calibration markings are 100 microvolts. D, E Needle electrode records, triceps muscle, same patient as C. D was taken before and E after intravenous Benadryl. Note the absence of change in burst frequency or duration.

reduction in tremor during and for several seconds after relaxation was a fairly constant finding. However, in spite of these differences, the pattern for a given patient was relatively constant.

Figure 2, A, B, C, D, shows a typical record of flexion with a 1000 gm. weight before and after intravenous Benadryl was given. A reduction of amplitude of activity after Benadryl in all the muscles examined is evident. The decrease in the antagonist triceps is most prominent. The overall pattern of the movement is remarkably constant even to the time relations of the appearance and disappearance of tremor. There is no significant change in tremor burst frequency, shape, or duration. There were four cases of clinical rigidity without tremor, two clearly post-encephalitic. Figure 2, E, F, shows resting records from one of the latter cases before and after Benadryl. Continuous tonic activity is evident in both but again a decrease in amplitude is evident in the latter.

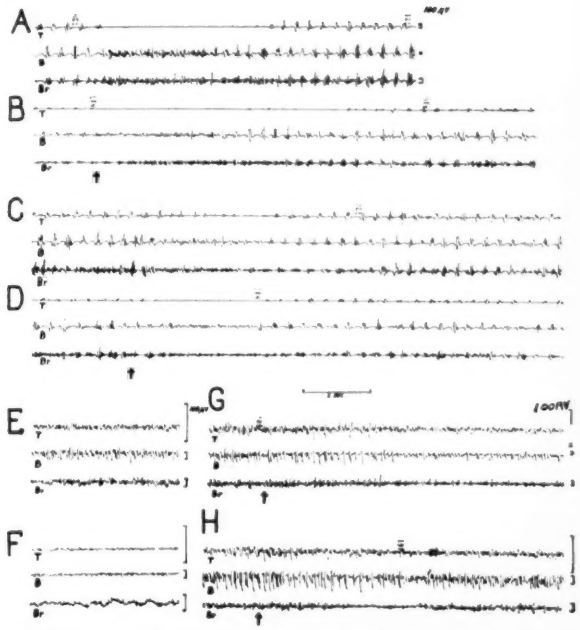

Figure 2. A, B, C, D Surface leads, same patient as Figure 1, B. Flexion with 1000 Gms. at signal in A and B and relaxation at signal in C and D. A and C are continuous control records. B and D are continuous record after intravenous Benadryl; calibration same in A, B, C, D. E, F, G, H patient with tonic rigidity. E and F, Resting record before and after Benadryl respectively. G and H, Sustained flexion with 1000 Gm, relaxation at signal, before and after Benadryl respectively. Calibration, 100 microvolts.

A lesser degree of the same change is evident during activity (Figure 2, G, H).

Side-effects noted in both controls and patients were a slight degree of drowsiness and some euphoria comparable to that of mild alcohol intoxication. These lasted only a few minutes after the injection. A subjective awareness of increased facility in finely modulated movements was very frequently noted by the patients. Determinations of maximal strength of willed movements were not made.

Comment

The electromyographic recordings of parkinsonian tremor and rigidity were those usually found. They have recently been ably discussed by Bishop et al.[13] In this study observations were made upon the acute effect of a known empirically effective drug, Benadryl, on the EEG and EMG in two normal controls, and on the EMG in 13 cases of paralysis agitans, idiopathic, arteriosclerotic, and post-encephalitic in etiology. The drug had no significant effect on the normal EEG or EMG. In the parkinsonian cases it

acted by generally depressing amplitude of muscle activity to one-half to one-tenth of the pre-injection amplitude. The drug did not affect tremor except as it reduced the amplitude of tremorous muscle activity. By this subtraction of involuntary excitation from both agonist and antagonist, the patient is able to perform a given amount of external work with considerably less overall muscular exertion. The depressant effect of the drug releases the agonists from the opposition of antagonists; that is, it releases rigidity or its periodic counterpart, tremor. It is this opposition which is the embarrassing factor of movement characteristic of paralysis agitans.

It is of interest to surmise, from this release of antagonists during effort under the influence of Benadryl, what the effect of the drug is on the underlying physiological pattern of movement in general. Two abnormalities characterize Parkinson's disease in this respect; the first is a tonic overexcitability, probably involving spinal mechanisms acted on by stretch afferents, the periodic or clonic form of this appearing in typical parkinsonian cases as tremor.[15] This change from the normal excitability is presumably due to interference with tonic inhibitory influences normally arising at the site of the lesion in the upper brain stem. The second abnormality is characterized by interference with the reciprocal relations of normally opposing muscles, in such a way that not only are opposing sets of muscles equally active at "rest" (that is without voluntary effort), but the activity of voluntary effort overflows, or is not reciprocally inhibited, to increase the activity of antagonists. This is the physiological aspect of rigidity and it results in the necessity of greater than normal effort for a given accomplishment, since the pull of the opposing muscles must be overcome. The cog-wheeling phenomenon consists of the periodicity of tremor superimposed on the increased activity of rigidity due possibly to stretch reflexes. This overflow from excitation of the agonist to its antagonist is demonstrable in many cases as a doubling of the tremor rate due to the spread of the tremor pulses of the biceps, for instance, to the triceps. When these two are in alternate contraction and the excitation of the biceps spreads to the triceps, instead of the triceps being reciprocally inhibited, it shows both tremor rates, or in effect shows a doubling of its frequency. Such doubled frequency may in fact appear in both muscles, the excitation of each spreading to the other. This results in a static tremor of twice the usual rate, the tremor bursts becoming synchronous in opposing muscles instead of alternate. Under these conditions overt tremorous movement is minimal and the manifestation appears clinically as rigidity.

The action of Benadryl on these two aspects of parkinsonism may be inferred from the records presented. The drug reduces the involuntary overexcitation either of tonic rigidity or of its periodic form, tremor and concomitantly reduces the spread of voluntary excitation to opposing muscles. In reducing this pathological overactivity Benadryl permits voluntary effort again to exhibit reciprocal inhibition of antagonists more nearly as it occurs in the normal subject, enabling the patient to accomplish a given movement without the necessity of working against his own muscles. It would appear that the reciprocal mechanism is not directly impaired in parkinsonism; rather it is probably masked by an overpowering spread of excitation and reappears when the latter is reduced.

If the effect of Benadryl is to decrease an overexcitability which developed by removal of inhibitory control, and the pathological character of the lesion in paralysis agitans strongly suggests a primary deficit rather than an excess of some influence, then its action may be inferred to be a compensatory depression of those functions whose overactivity is released in this disease. It is impossible to infer from present information what specific mechanisms are involved, but the characteristic drowsiness induced by Benadryl is consistent with a depressant rather than an excitant action. Clinically Benadryl seems to be a drug which most specifically depresses this overactive center, locally, with as little involvement as possible of other nervous tissues.

Parkinson tremor is reduced or abolished on removal of cortex in the vicinity of area 4 (together usually, and perhaps not inci-

dentally, with some loss of voluntary motor function).[16] Physiologically, reciprocal activation and inhibition of voluntary movement have representation in the higher levels of the brain. Together these facts suggest that the critical locus of action of this drug is at least above the spinal level (which again is consistent with its action in causing drowsiness) but below the cortical level, since voluntary control is not impaired.

Such inferences may indeed be more appropriately applied as leads to further investigation than as a definitive explanation either of the physiology of parkinsonian disease or of the site and nature of action of Benadryl. On the other hand, it is not known in detail whether the effect of Benadryl given parenterally is identical with its effect when given orally in divided doses at a level adequate for the control of rigidity. A few cases so far examined indicate that the results of oral administration are similar, and such studies are being continued.

Summary

EEG and EMG recordings on two normal subjects were obtained before and after intravenous injection of 30 mgms. of Benadryl. No effects were noted. Surface and needle electrode EMG recordings were done on 13 cases of paralysis agitans before and after the same quantity of intravenous Benadryl was given. Records were taken from biceps and triceps brachii and brachioradialis muscles. The effect of Benadryl was upon the amplitude of muscle activity, both at rest and during movement. Tremor rate and regularity were not affected. The specific locus of the drug's action could not be determined but suggestive evidence is presented that the site is supraspinal and subcortical. It was concluded that a relatively specific depressant action of Benadryl at this site accounts for the drug's beneficial effect in parkinsonism.

ACKNOWLEDGEMENTS:

The generous advice and criticism given throughout the course of this work by Drs. George H. Bishop and James L. O'Leary are gratefully acknowledged.

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An Elaboration of A Distinctive EEG Pattern Found During Drowsy States In Children *

CAPT. PAUL W. DALE, M.C., U.S.A.
EWALD W. BUSSE, M.D.
Denver, Colorado

There is a peculiar and characteristic wave pattern occurring in the electroencephalograms of young children while they are in a state of light drowsiness. Smith noted and described accurately this cortical activity as it appeared in infants as they were going to sleep.

"With the infant lying awake and quiet (eyes open, alert) the alpha waves may appear over the occipital area for a short time before any well-defined activity has begun to show over the sensory-motor region. Often, however, this initial alpha phase is less well-defined and the sensory-motor area will already show beginning sequence of drowsy waves at about 4 per second in company with the occipital alpha waves. As the child begins to drowse and his eyes start to droop, these slow waves tend to be reinforced over the sensory-motor region, usually reaching their peak just before the eyes close. . . . After the eyes close, the series of the large slow drowsy waves become progressively shorter and less regular . . ." (p. 478).

Smith, P. R., *J. Genet. Psychol.*, 53, 1938.

"These waves are conveniently referred to as 'drowsy waves' because they appear characteristically in older infants during pre-sleep and drowsy states. Similar waves have been described as appearing during sleep in adults by Gibbs, Davis and Lennox and Davis, Davis, Loomis, Harvey and Hobart" (p. 434).

"Beginning apparently during the third year, the decrease proceeds gradually thereafter until in children over five years of age this activity is noticeably less dominant than in infants and younger children" (p. 446).

The present study was undertaken to characterize these so-called "drowsy-waves" and to determine whether or not they can be considered a normal finding and what relation, if any, they have to disturbed brain function.

Technique

The records on which this study was based were made on an eight channel and a four channel electroencephalgraph of recent manufacture. Scalp-to-ear of the corresponding side and scalp-to-scalp leads were employed routinely. Where sleep records were obtained, the sleep was natural sleep in that no hypnotic drugs were employed. There is some indication, which we hope to further follow up, that barbiturates will distort the normal EEG pattern during drowsiness in children as well as in adults.

The records of normal children were obtained from children of professional persons with reasonably reliable histories. For our purposes a child was considered normal if he had no history of convulsions at any time, no history of unconsciousness, of bizarre behavior, of head injury with coma, of unusually traumatic conditions at birth, and no history of any convulsive disorder in any member of the family far back as could be traced.

The records included in the referred series are those of children referred to this EEG department for examination. These children usually had findings in the history or on physical examination which prompted the referring physician to request an EEG.

The referred series group was further subdivided into records which, irrespective of the presence or absence of drowsy activity, did or did not show abnormality.

In accordance with Gibbs' classification, all S_2, S_3, F_2, and records with paroxysmal activity were considered abnormal. S_1 and F_1, were classified as borderline records. We took as our normal awake record standard: Age 1 year, few 2-3, many 3-6, few 6-8, rare 8-10; 2 years, rare 2-3, some 3-6, some 6-8, some 8-10; 3 years, rare 2-3, some 4-6, many 6-8, some 8-10; 4 years, some 4-6, many 7-9, some 9-12; 5 years, few 4-5, some 5-7, many 7-10, few 10-12; 6 years, few 4-6, some 6-8, many 8-10, few 10-12; 7 years, few 4-6, some 6-8, many 8-12; 8 and 9 years, rare 4-5, some 6-8, many 8-12; 10 years, very rare 4-5, few 6-8, many 8-12; 11-13 years, few 6-8, many 8-12. The terms "rare," "few," "some," and "many" are elastic, but are respectively roughly equivalent to 1/6 or less, 1/8-1/4, 1/4-1/2, and 1/3 or more. The amount of L.V.F. activity, which is often superimposed upon a shifting baseline, varies considerably in children's records. In the early

From the Departments of Electroencephalography and Psychosomatic Medicine, University of Colorado Medical School, Denver, Colorado.

*Read before the Central Association of Electroencephalographers.

years it often occupies approximately 1/8 of the record and steadily increases as the age advances. We well recognize the wide EEG frequency spectrum in children and the considerable normal variation; but the above standard gives a frame of reference from which the records that are clearly too slow or too fast can be recognized.

Observations

In Figure 1 are EEG's from normal children of varying ages illustrating drowsy activity. The principal difference from child to child is not in pattern or frequency but in amplitude and duration of the runs.

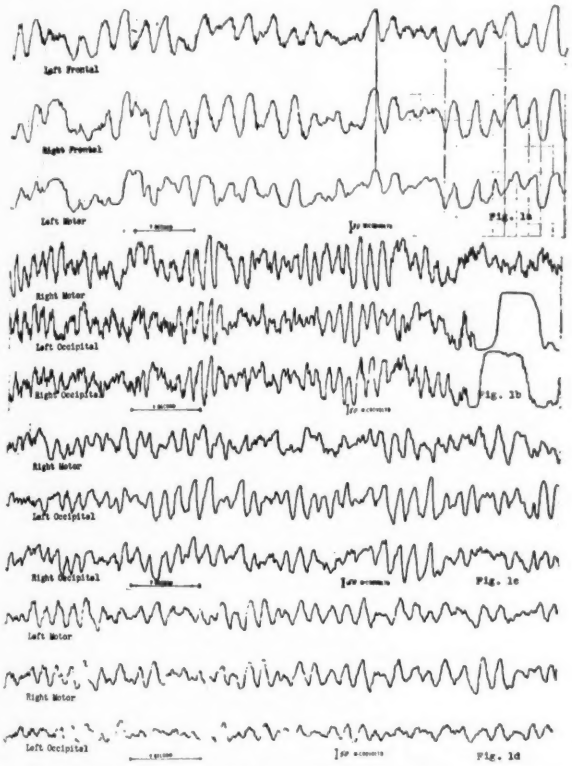

Fig. 1. Drowsy-waves from records of the normal series.
Fig. 1a. Age 5 months. Normal series.
Fig. 1b. Age 3½. Normal series.
Fig. 1c. Age 3½. Normal series.
Fig. 1d. Age 1½. Normal series.

We have found Smith's description of drowsy-waves to coincide with the activity as illustrated in Figure 1 A. In our experience drowsy-waves are almost invariably present just before or just after sleep in the age group of 9 months to 3 years. These waves are most marked during the awakening period or just after it, or when the child seems excessively irritable either before or after sleep. Some children may show well developed drowsy-waves even when there is no objective evidence of drowsiness. This was true in Figure 1 B. They characteristically appear in regular sinusoidal runs of high voltage with each wave of nearly equal frequency and amplitude. There is a slight frequency shift from 4-5 per second in infants of about 9 months to 5-6 per second for children of 3 to 4 years. (Compare in Figure 1, A with B.) The shift toward faster frequencies proceeds at a much slower pace than it does for the occipital alpha while awake. The amplitude is usually in the 100 to 150 microvolt range. They usually start in the motor area and spread to all leads, continuing to be most prominent in the motor and occipital areas. The drowsy-waves show a definite and rapid decline beyond the age of 7. Children with other evidence of disordered cortical function may show activity resembling drowsy waves of infantile pattern as late as 10 years of age (Figure 2).

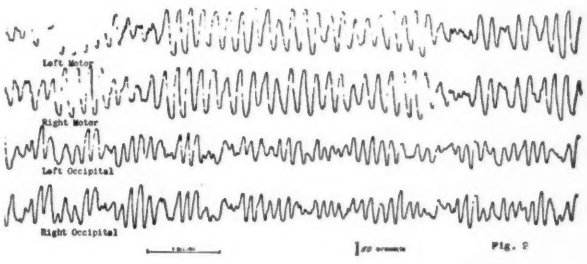

Fig. 2. Age 10. Grand mal seizures. Record resembles drowsy-waves but slightly faster.

Although drowsy-waves may repeatedly fail to show very strongly in a particular child during the ordinary sequential changes in pattern accompanying the onset of sleep, they may be reestablished under special conditions. If, for example, a young child in whom this pre-sleep activity is much attenuated, is permitted to doze off for a short time and is then aroused to the point at which his eyes open momentarily, the drowsy-waves frequently come back in force for a short interval. In some children the initial resurgence of the drowsy-waves under these conditions may take the form of an unbroken sequence lasting as long as 30 seconds.

Drowsy-waves begin to disappear in normal children at 4 to 5 years of age. They are observed less frequently and when seen the sequences are of shorter duration. In-

stead of the long, well-defined runs of these waves during the pre-sleep period, only short isolated series are present, chiefly in the sensory-motor region.

Smith in his papers described the drowsy-waves as a finding in normal children. We agree and have found drowsy-waves appearing in the electroencephalograms of children under six years of age, irrespective of whether the EEG is normal or abnormal.

We have examined 22 sleep records of normal children from 1 month to 6 years of age and 116 additional sleep records of children who were referred for examination. Of the sleep records from the children referred for EEG examination, 56 failed to demonstrate any cortical disturbance and 60 were abnormal as outlined above.

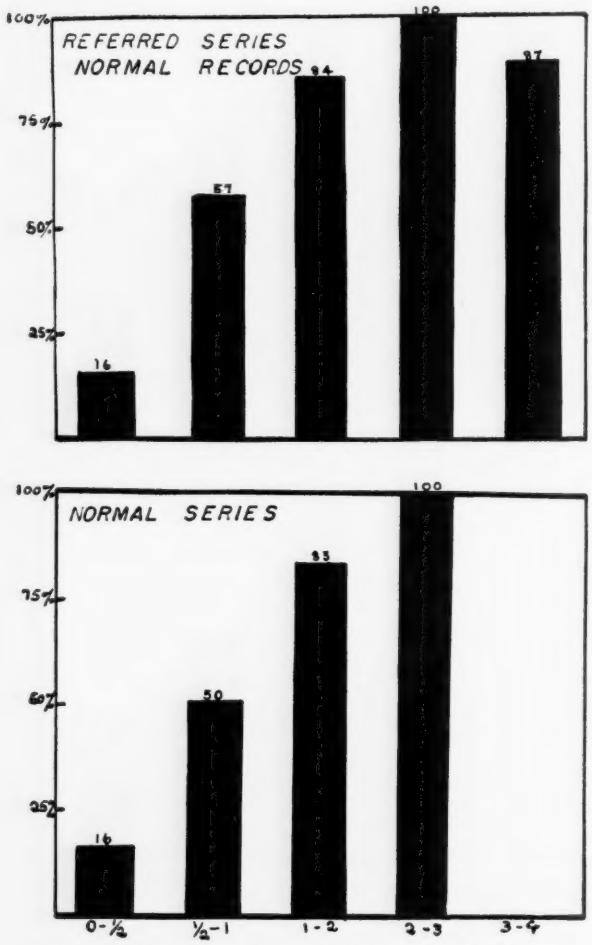

Fig. 3. The percentage of sleep records showing drowsy-waves in the normal series and in the normal records of the referred series.

Figure 3 graphs the percentage of normal sleep records showing well defined drowsy-waves in both the normal series and the "referred" series. Figure 4 graphs the number of records that did or did not show drowsy-waves.

From the data, it is apparent that drowsy waves are a normal finding in young children from 6 months to 5 years. As the relative number of records showing drowsy-waves in the normal series, the normal records of the referred series, and the abnormal records of the referred series is about the same, the presence or absence of drowsy-waves cannot be used as a criterion of whether or not the record is normal or abnormal.

Drowsy-waves are not present at birth and are not seen in adolescence, thus it is apparent that their presence is confined to an age group between these two extremes. Figure 3 (lower graph), giving the percentage of sleep records of normal children showing drowsy-waves, demonstrates a gradual increase to 100% for the 2-4 age group. Further breakdown of the 0-1½ year bar would show a similar decline in the appearance of drowsy-waves approaching zero for one month and under. We do not have enough data beyond 4 years in the normal series to justify a representation on a percentage basis. This is largely occasioned by the difficulty of obtaining natural sleep records in youngsters of this age.

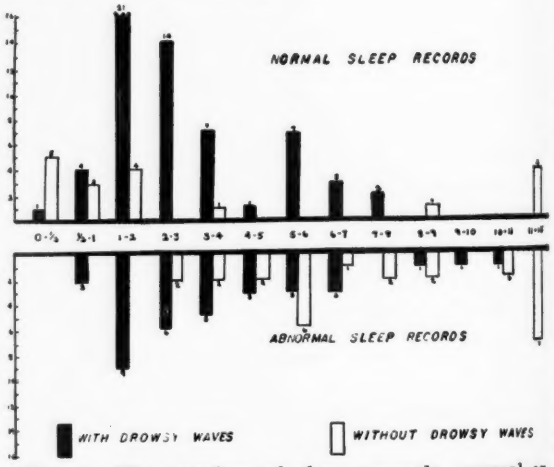

Fig. 4. The number of sleep records, normal or abnormal, that did or did not show drowsy waves.

On examining the records of the referred series, it becomes apparent that the appearance of drowsy-waves in sleep records becomes less frequent beyond 7 years of age. To date, records of children older than 7 years that showed drowsy activity have shown EEG evidence, separate from the

drowsy-waves, of abnormality. Figure 4 suggests that children over 6 years with abnormal EEG's tend to sleep more readily during the course of examination and may have drowsy-waves in their electroencephalogram up to about 11 years of age. Thus the presence of drowsy waves in the record of a child over 8 years of age suggests that there may be some cortical dysfunction.

Some care must be exercised not to confuse the runs of drowsy-waves with runs of abnormal slow activity. Drowsy-waves are best differentiated from other cortical activity by their pattern as well as by the time of their appearance in relation to the sequential changes seen in the EEG as the subject goes to sleep or arouses. However, they may appear without objective evidence that the child is drowsy. These points are generally useful in identifying drowsy-waves: 1. They appear just before sleep or on arousing; 2. They generally appear first in the sensory-motor leads, sometimes first in the occipital leads; 3. They spread to all leads; and 4. Although they may appear abruptly, especially after sleep, they show a gradual increase and declined in the amplitude of any particular run. Compare the drowsy-waves after sleep in a normal 2½ year old child in Figure 5 A with the burst of abnormal slow waves in a 6 year old child with a history of behavior disorder in Figure 5 B.

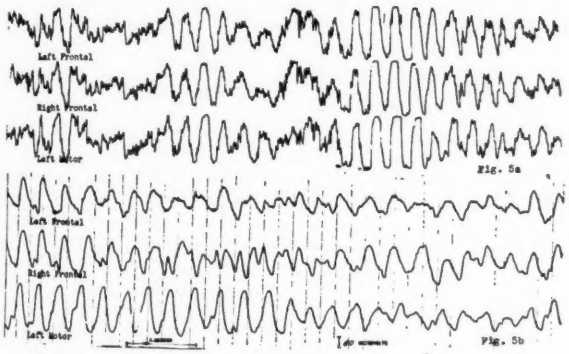

Fig. 5. Comparison of drowsy-waves from a record of the normal series with a paroxysmal S2 record.

Fig. 5a. Age 2½. Normal series.

Fig. 5b. Behavior problem child of retarded development with spells of weakness, dizziness and temper tantrums.

In older children and adults with histories of a cortical disturbance activity may be noted which has a resemblance to drowsy-waves. Perhaps these abnormal slow waves are a demonstration that the cortex returns for a brief period to an infantile pattern of electrical activity. In young children it is a normal activity in drowsing and irritable states, while in older patients it represents pathologic cortical function. The drowsy-like waves of a 10 year old child with grand-mal seizures in Figure 2, may represent an abnormal persistence of drowsy-waves. Figure 6 illustrates drowsy-wave-like activity in an adult after electro-convulsive therapy.

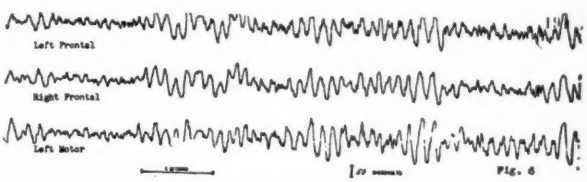

Fig. 6. Adult. After electro convulsive therapy. As S2 record resembling drowsy-waves as seen in young children but somewhat faster.

Summary and Conclusion

We have attempted to supply a description of a characteristic cortical activity occurring in the sleep records of children which Smith has aptly labeled "drowsy waves." It is our opinion that this activity is a normal finding in children from 6 months to 7 years. We have outlined the characteristics by which drowsy-waves can be distinguished from abnormal activity in this age group; for care must be taken not to confuse this cortical rhythm with abnormal slow or abnormal paroxysmal activity in children under the age of seven.

We have briefly speculated on the relationship of this activity occurring during drowsy and irritable states in children with abnormal activity of similar pattern seen in older persons.

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